



# WATER SENSITIVE URBAN DESIGN

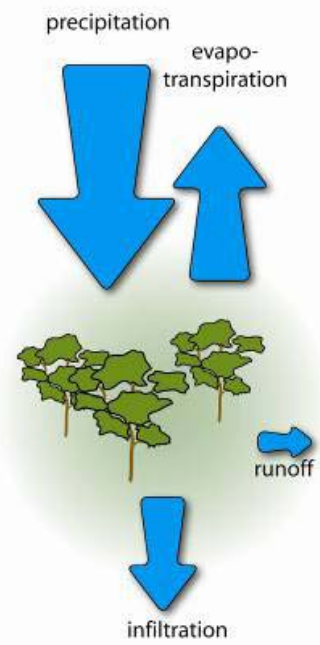
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David Knights

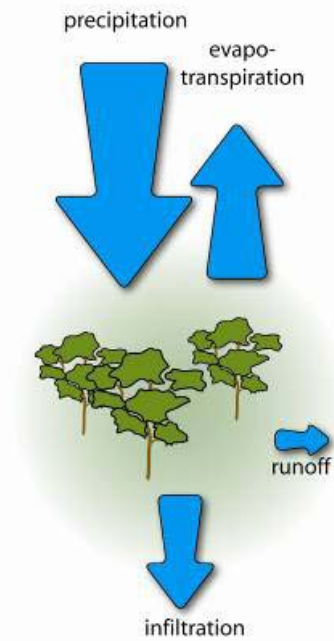
Shaun Leinster

Phill Piper

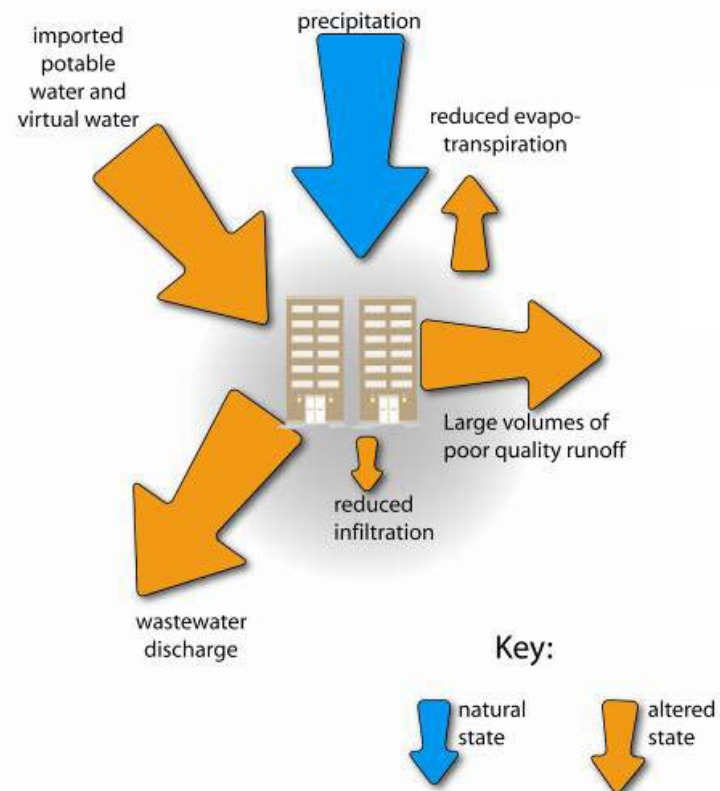
## natural water balance



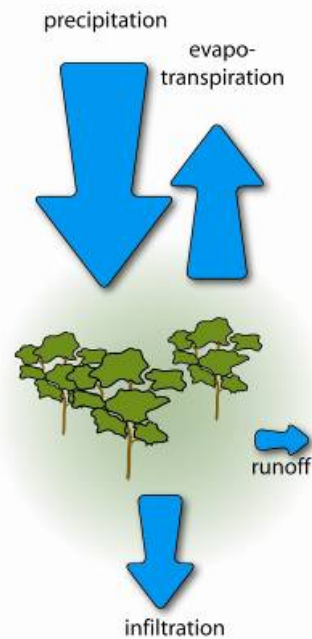
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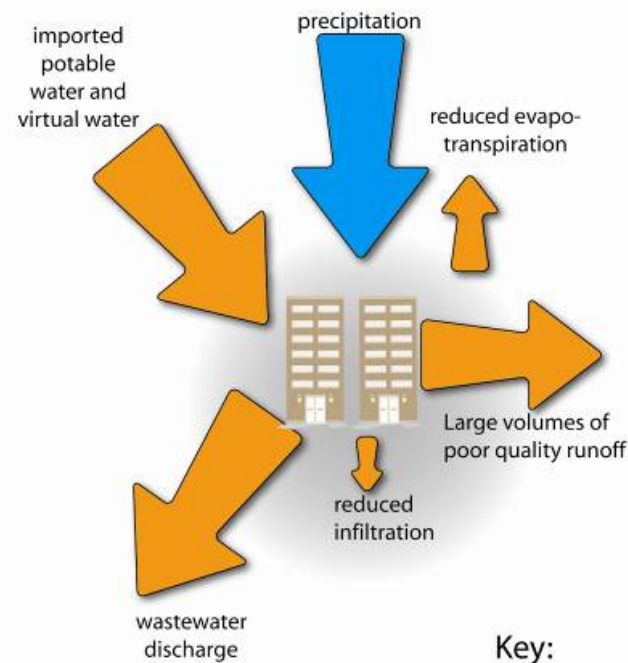
## Urban water balance



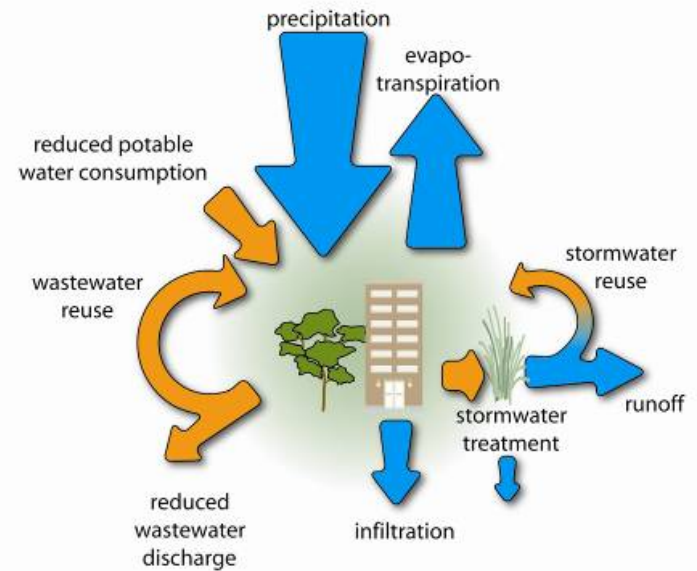
### natural water balance



### Urban water balance



### WSUD water balance



Key:



Hoban & Wong, 2006

# WHAT IS WSUD?

- WSUD has evolved from its early association with stormwater management to provide a broader framework for sustainable urban water management.
- “WATER SENSITIVE”
  - Sustainable solutions for managing water resources
  - Protecting aquatic ecosystems
- “URBAN DESIGN”
  - Integrating into the urban design
  - Enhancing the landscape/recreation/habitat
  - Creating an “Urban Ecology”

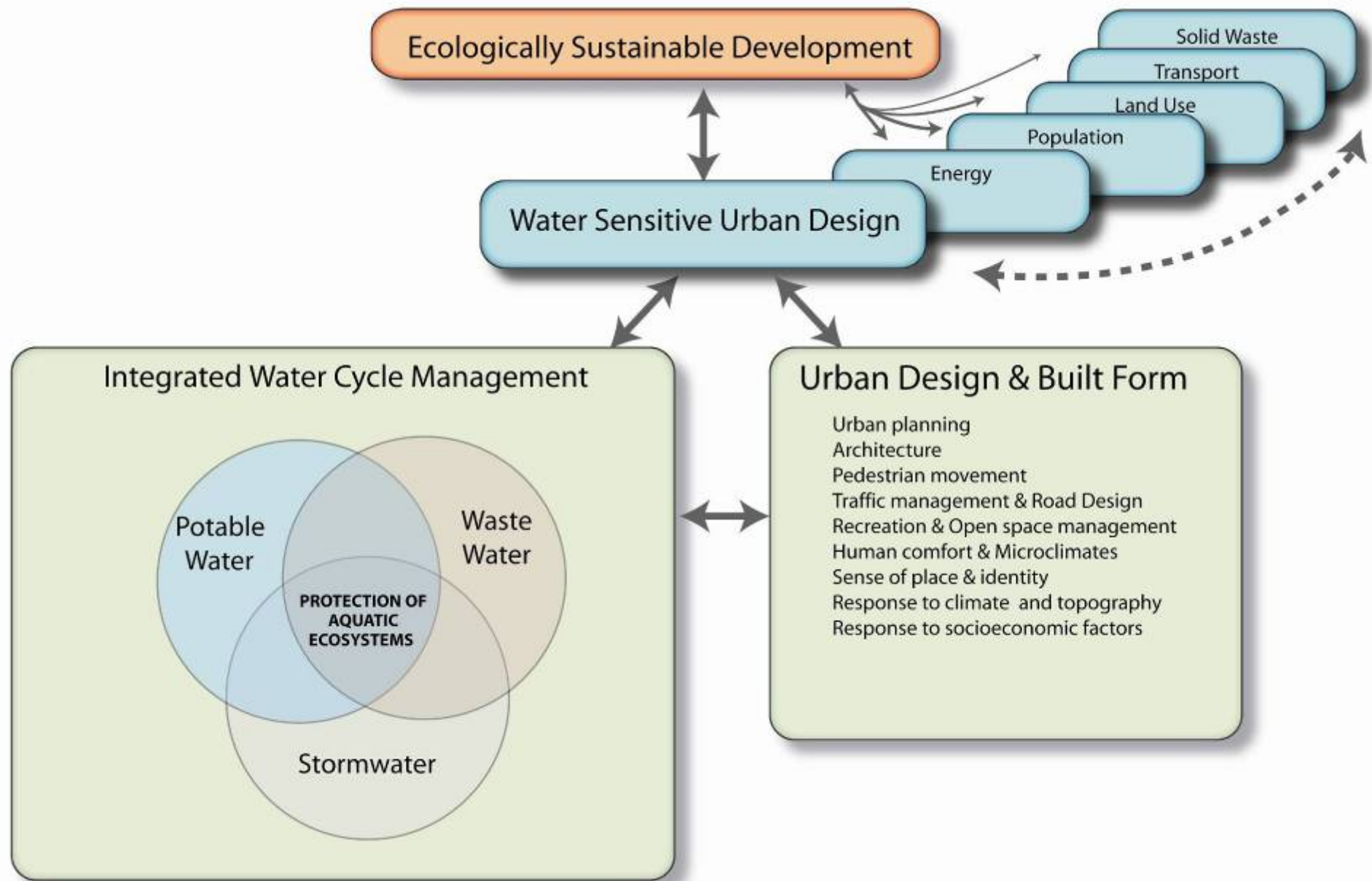




# KEY PRINCIPLES OF WSUD

- Protection of natural and aquatic ecosystems
  - Protect water quality of surface and groundwaters (best practice treatment of stormwater)
  - Maintain the natural hydrology
- Minimise the demand for potable water
- Minimise wastewater generation and discharge to receiving environments
- Integration of water into the landscape and urban design to maximise visual, social, cultural and ecological value







# WSUD = INTEGRATION.....

- Integration across the urban water streams
  - Potable water
  - Wastewater
  - Stormwater
  - Groundwater





Potable water  
supply and  
treatment plant



*Natural environment*

*Built environment*



Human  
consumption  
- kitchen



Hot water  
system



Shower and  
bathroom taps



Clothes  
washing



Toilet flushing



Garden  
irrigation

*Built environment*

*Natural environment*

**Sewerage  
treatment plant  
(STP)**

**Urban  
Runoff**

Discharge

Potable water supply and treatment plant



**MINIMISE**

Natural environment

Built environment



Human consumption - kitchen

Hot water system

Shower and bathroom taps



Clothes washing

Toilet flushing

Garden irrigation

Built environment

Natural environment

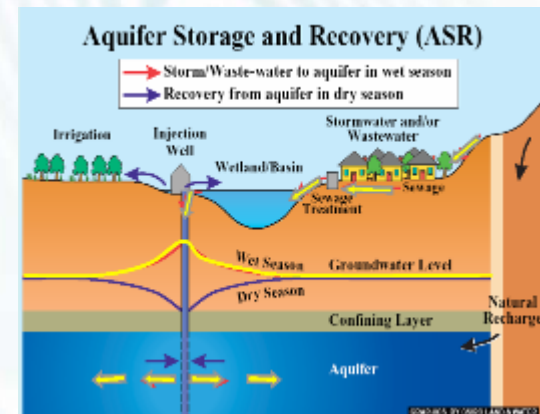
Sewerage treatment plant (STP)

**MINIMISE**



Stormwater treatment Train

**STORAGE REUSE**



Discharge

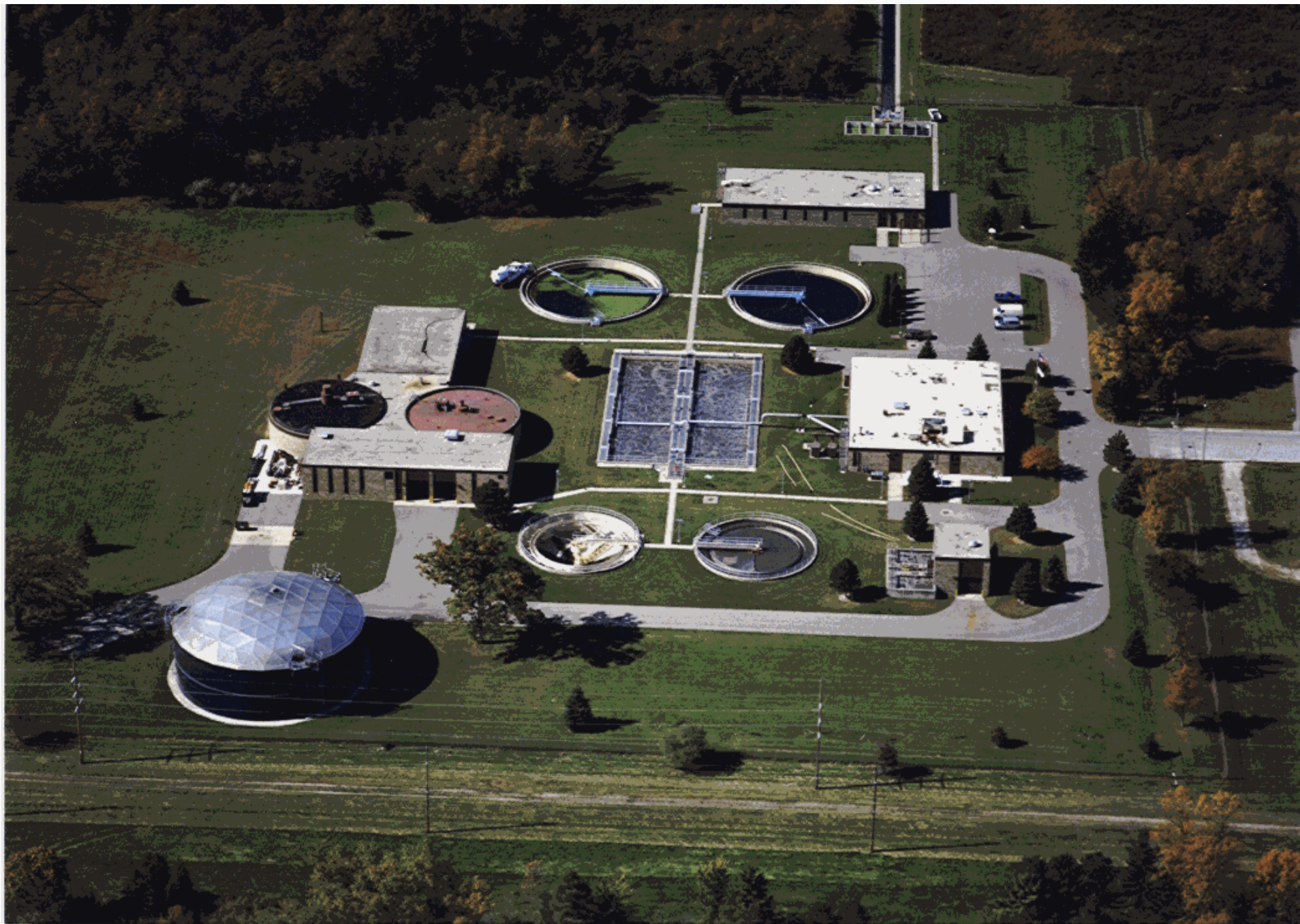
**PROTECT ENVIRONMENT**

# WSUD = INTEGRATION.....

- Integration across the urban water streams
  - Potable water
  - Wastewater
  - Stormwater
  - Groundwater
- Integration of scale
  - Regional
  - Precincts
  - Streetscapes
  - Allotments

















# INTEGRATION OF SCALE - Wetlands

Regional  
Scale

Allotment/Forecourt  
Scale



Hampton Park Wetland  
(Melbourne)



Lynbrook Estate Wetland  
(Melbourne)



Coomera Waters Wetland  
(Gold Coast)



NAB Building Forecourt Wetland  
(Melbourne Dockland)





REGIONAL SCALE - Hampton Park Wetland (Melbourne)





SUB REGIONAL SCALE – Moore Park, Sydney





PRECINCT SCALE – Coomera Waters, Gold Coast



# WSUD = INTEGRATION.....

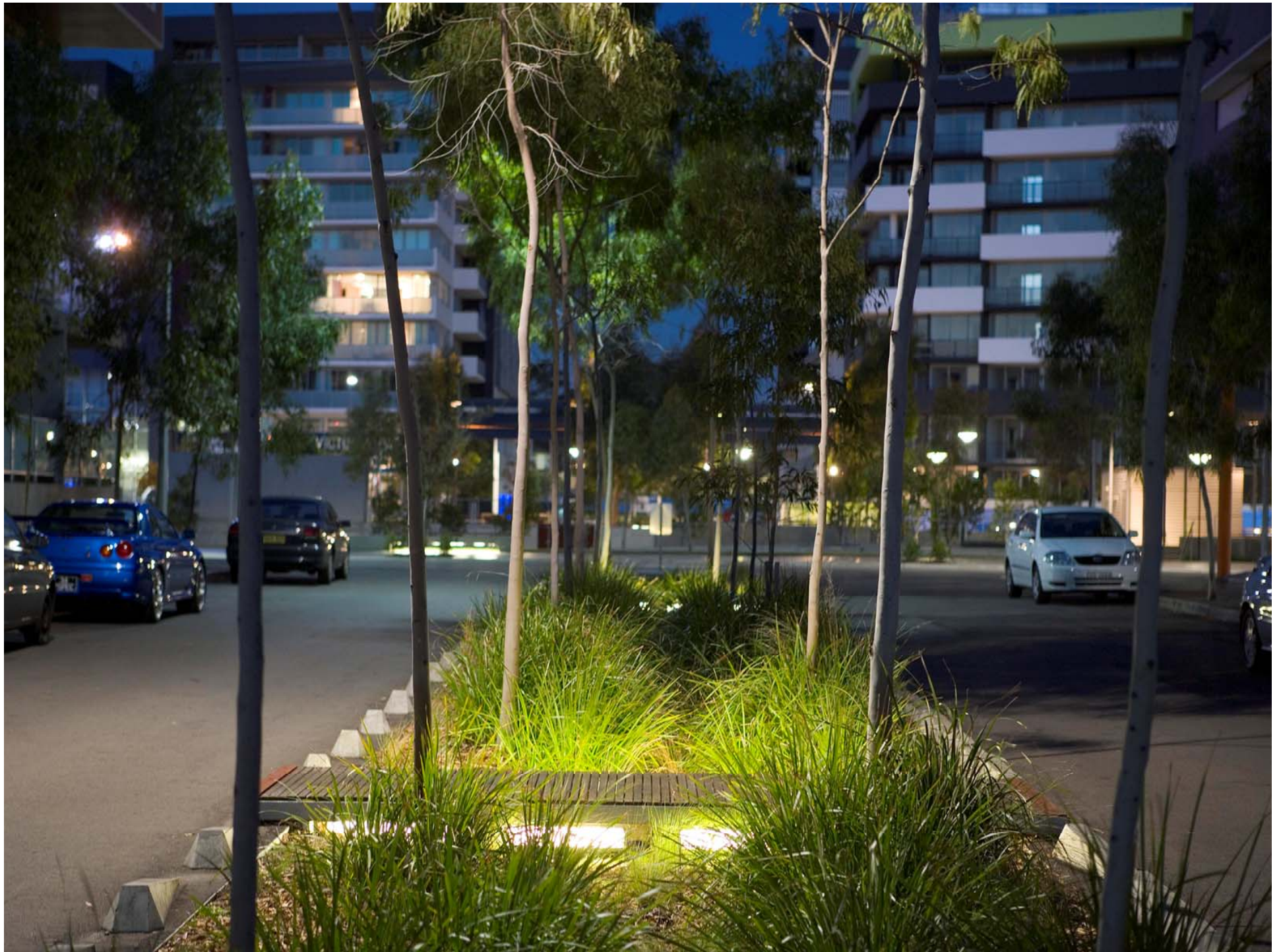
- Integration across the urban water streams
  - Potable water
  - Wastewater
  - Stormwater
  - Groundwater
- Integration of scale
  - Regional
  - Precincts
  - Streetscapes
  - Allotments
- Integration into built form
  - Building Architecture
  - Landscape architecture
  - Public Art





Landcom Sustainable Design





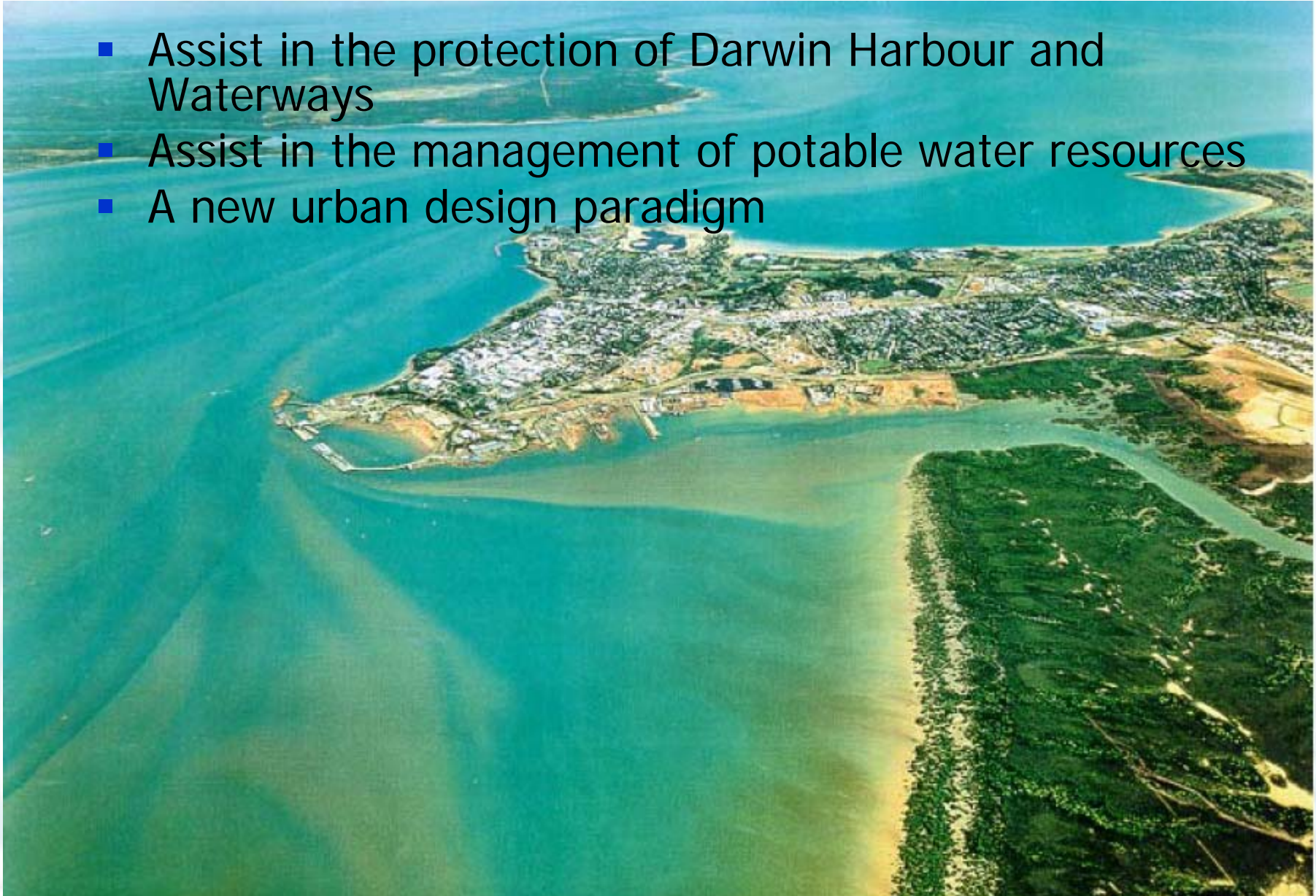






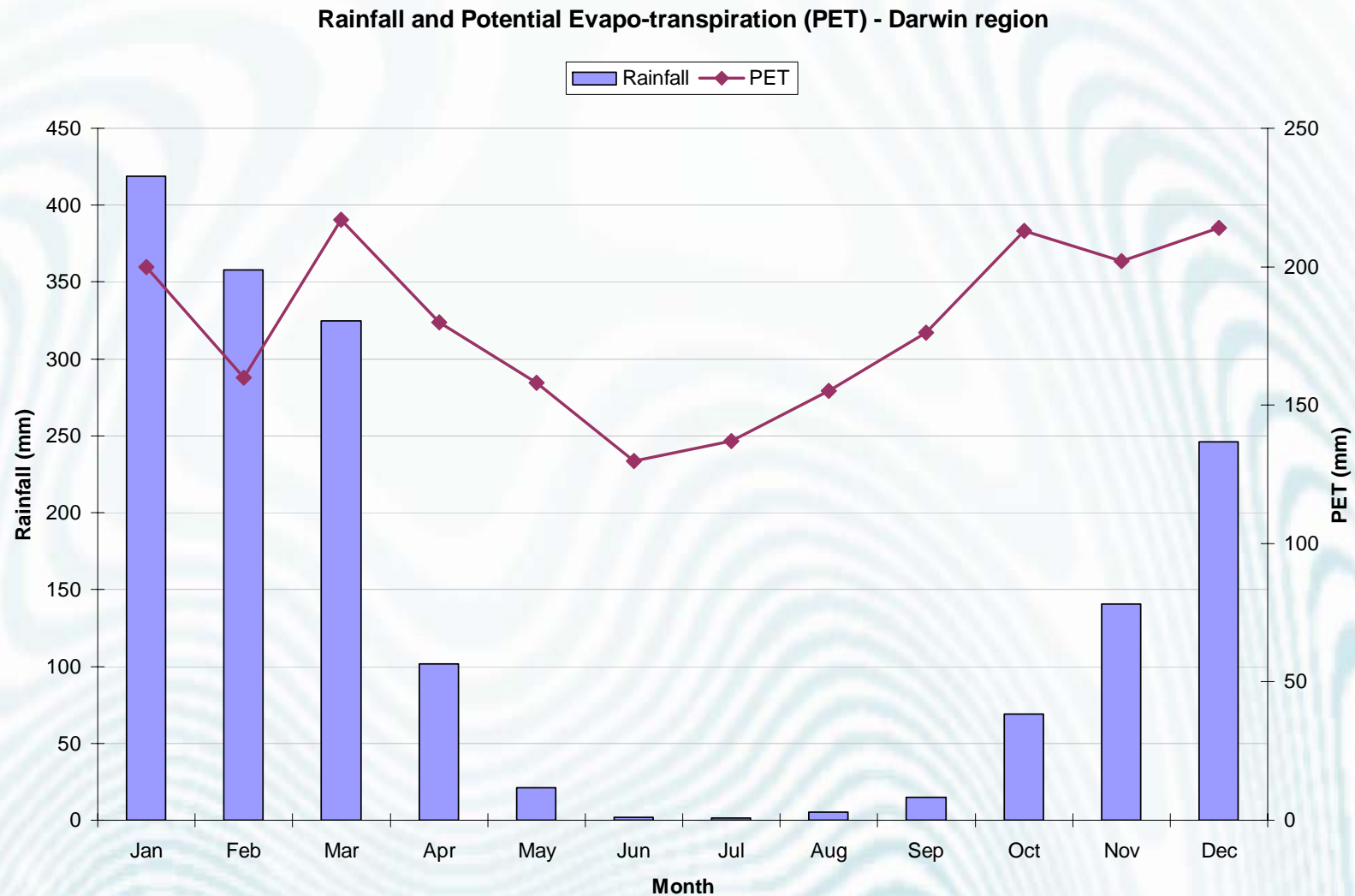
# WHY WSUD IN DARWIN?

- Assist in the protection of Darwin Harbour and Waterways
- Assist in the management of potable water resources
- A new urban design paradigm



# WSUD IN DARWIN – DESIGN ISSUES?

- Climate of the wet-dry tropics underpins design





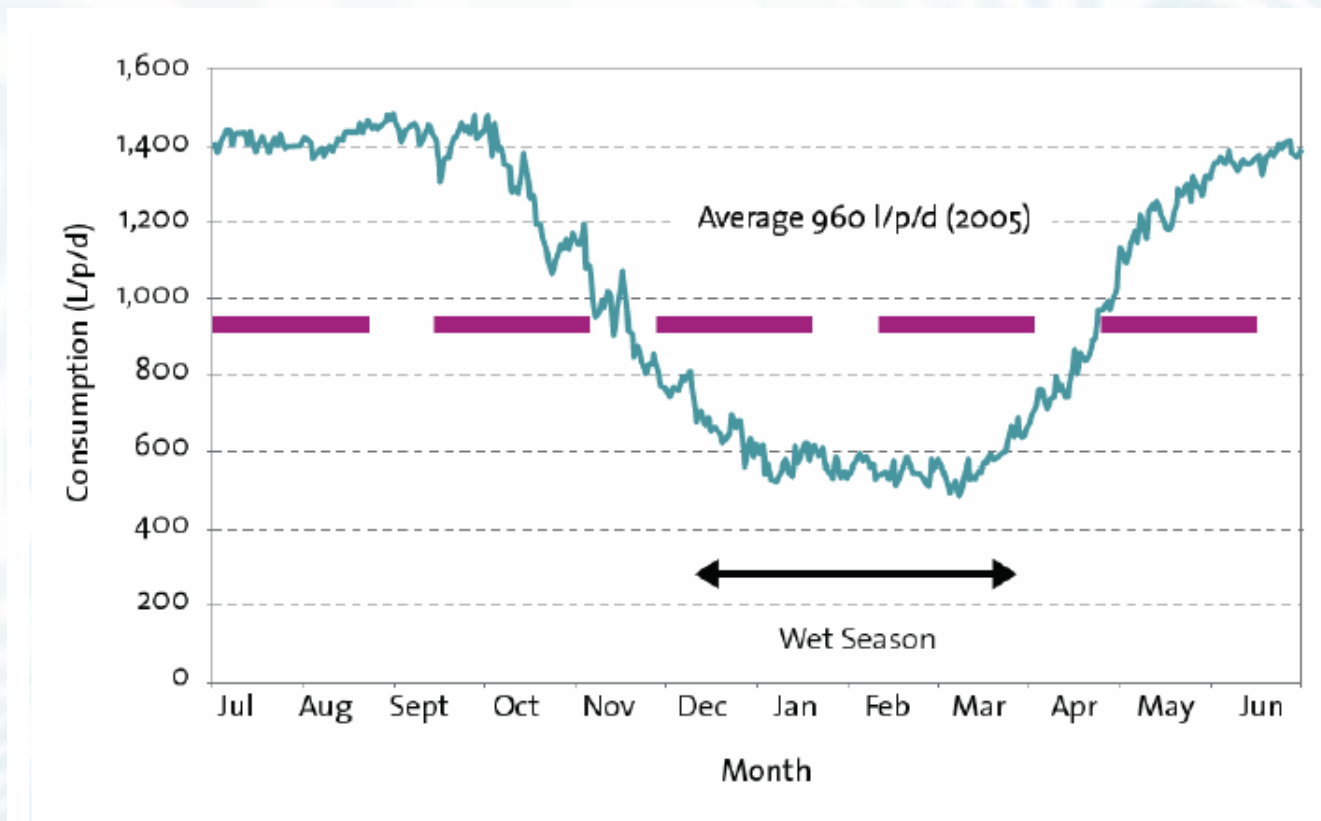
# WSUD IN DARWIN – STORMWATER

- Size of stormwater treatment systems larger than temperate regions to treat same proportion of annual volumetric runoff
- Storages for reuse - size and operation
- Vegetation in natural treatment systems need to withstand long periods of dry and long periods of intense rain events
- Control of biting insects



# WSUD IN DARWIN

- Potable water demand
  - Dominated by irrigation during dry season



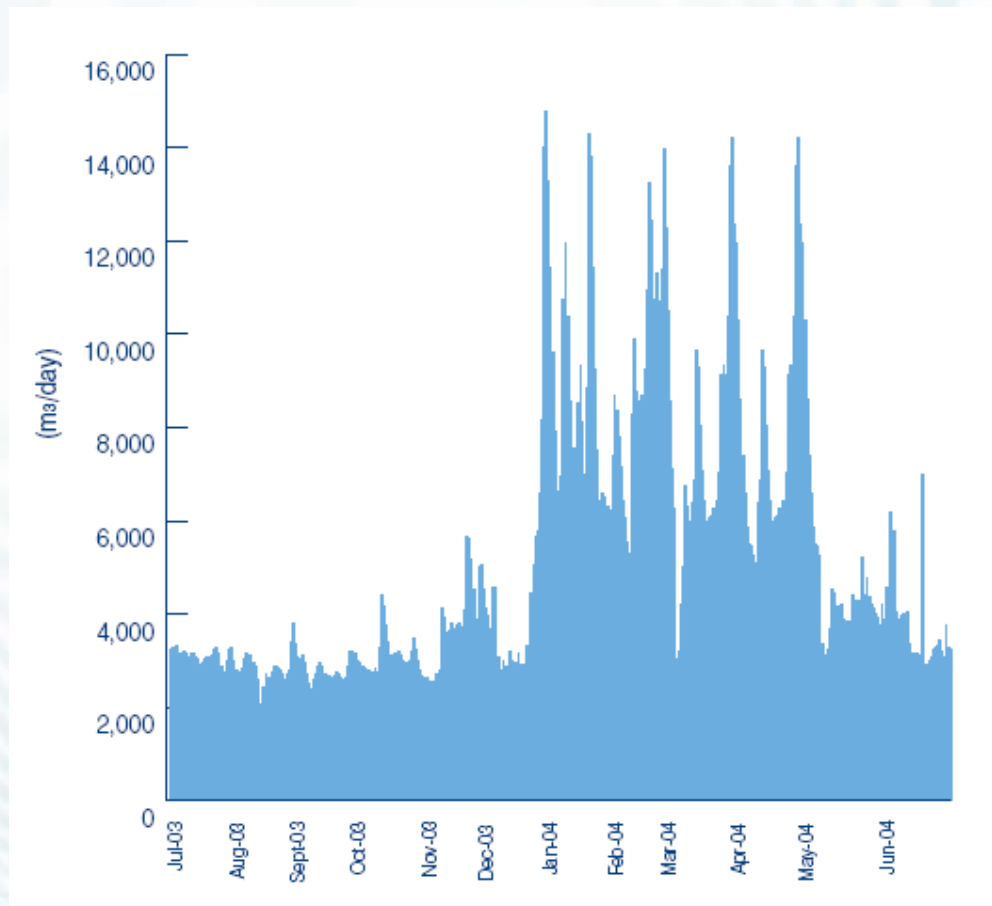
Power & Water Corporation, 2006



# WSUD IN DARWIN

- Wastewater
  - Significant volumes of infiltration and ingress during wet season

**Palmerston STP**



# WSUD IN DARWIN – BELLAMACK

- WSUD is a key design principle for the development





# BELLAMACK - Site

- Total land area = 118.6ha
- Development area = 75ha
- Develop intent
  - 650 detached dwellings
  - 200 townhouses
  - 16 'shop top' units
  - 20 rural style
- Design Principles
  - Water Sensitive Urban Design
  - Circulation
  - Open Space
  - Neighbourhood Centre
  - Housing diversity
  - Climate control and energy efficiency

# BELLAMACK – Objectives

IWCM Objective	Performance Measure/Target
Stormwater Quality	<p>Stormwater discharged from development areas to be treated in accordance with best practice:</p> <ul style="list-style-type: none"> <li>• 80% reduction in the mean annual load of Total Suspended Solids (TSS)</li> <li>• 60% reduction in the mean annual load of Total Phosphorus (TP)</li> <li>• 45% reduction in the mean annual load of Total Nitrogen (TN)</li> <li>• 90% reduction in the mean annual load of Gross Pollutants</li> </ul>
Potable Water Conservation	<ul style="list-style-type: none"> <li>• Reduce the garden irrigation demand for potable water by adopting low water use landscapes in public parks and encouraging low water used gardens on private allotments.</li> <li>• Reduce the indoor demand for potable water through the adoption of mandatory dual flush toilets and encourage the adoption of water efficient fixtures and appliances</li> <li>• Maximise the use of treated wastewater and groundwater for non-potable end uses, in particular landscape irrigation which constitutes 65% of residential water demand.</li> </ul>
Wastewater Minimisation	<ul style="list-style-type: none"> <li>• Minimise the generation of wastewater from Bellamack, through demand management and the reduction of wet weather infiltration.</li> <li>• Maximise the use of treated wastewater for non-potable end uses</li> </ul>
Landscape Integration	<ul style="list-style-type: none"> <li>• The stormwater management elements for Bellamack to readily integrate into the landscape of public realm zones and add value to the experience of visitors and residents.</li> </ul>



# BELLAMACK – Concept Design



**Constructed  
Wetland**

**Bioretention Basin  
(alternate option)**

**Existing Sediment  
Basin**

**Constructed  
Wetland**

**Constructed Wetland**

**Constructed Wetland  
(alternate location)**

# WSUD STRATEGY FOR DARWIN

- A component of the CCI program
- Development of Bellamack as a WSUD showcase
- Identify preliminary WSUD Design Objectives for Darwin
- Critical analysis of Stormwater Treatment Options for Darwin



## WATER SENSITIVE URBAN DESIGN DESIGN OBJECTIVES FOR DARWIN DISCUSSION PAPER

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Prepared for the Northern Territory Department of Planning and Infrastructure  
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October 2007  
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## WATER SENSITIVE URBAN DESIGN STORMWATER TREATMENT OPTIONS FOR DARWIN DISCUSSION PAPER

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